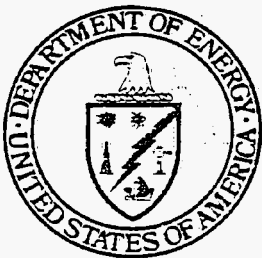


# ENVIRONMENTAL MONITORING REPORT ON DEPARTMENT OF ENERGY FACILITIES AT GRAND JUNCTION, COLORADO, AND MONTICELLO, UTAH, FOR CALENDAR YEAR 1985

MRAP 00111 AR 511 1-14 ENV MONITOR  
1985 ENVIRONMENTAL MONITORING REPORT, US DOE  
FACILITIES, G. J. CO AND MONTICELLO, UT 3/86

March 1986



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This report is a result of work performed by Bendix Field Engineering Corporation, Operating Contractor for the U.S. Department of Energy, Grand Junction Projects Office.

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FOR CALENDAR YEAR 1985

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March 1986

Prepared for the U.S. Department of Energy  
Assistant Secretary for Nuclear Energy  
Grand Junction, Colorado, Projects Office  
Under Contract No. DE-AC07-76GJ01664

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**Section I**

**SUMMARY**

## GRAND JUNCTION PROJECTS OFFICE FACILITY

The shallow gravel aquifer that underlies the Grand Junction, Colorado, Department of Energy (DOE) facility is contaminated by uranium mill tailings. Uranium, molybdenum, arsenic, and selenium are all found in significantly elevated concentrations. For example, the Safe Drinking Water Act has set limits of 0.05 mg/l arsenic and 0.01 mg/l selenium. Both of these limits are regularly exceeded in groundwater samples collected within 6 meters of the Gunnison River. Selenium levels have been as high as 0.066 mg/l, and arsenic levels as high as 0.51 mg/l. There are no standards promulgated for molybdenum, but the National Academy of Sciences (1972) has suggested a limit of 0.01 mg/l for agricultural use. One well near the perimeter of the facility, and within a few meters of the river, contains approximately 2.0 mg/l molybdenum. Uranium levels correlate well with those of molybdenum except that they are generally greater, with several wells on the river dike containing more than 1 mg/l.

Surface water on the facility consists of two lagoons and a drainage ditch. The most serious contamination detected in 1985 was radium-226 in the ditch adjacent to the river dike. Results of the November 1984 sampling indicate a radium-226 concentration in the ditch of 50 pCi/l compared with the standard for drinking water of 5 pCi/l.

Samples were collected from the Gunnison River four times during the year at points upstream, alongside, and downstream of the facility. During one sampling period, five additional samples were collected alongside a large riverside tailings deposit. In no instance were uranium-related contaminants detected in the samples. Thus, the effect of the contaminated aquifer on the river is assumed to be negligible; however, this cannot be verified without additional testing.

In addition to the contamination discussed above, the presence of polychlorinated biphenyls (PCBs) is addressed in this report. Transformers on the facility have been properly labeled, and PCB-contaminated waste was disposed of in 1983.

There have been no significant process changes and no air-quality impacts reported during 1985. In response to the need to describe background conditions for the pending remedial action, however, three high-volume air samplers were installed in December 1985. Data from these samplers will be reported in the 1986 Environmental Monitoring Report.

## MONTICELLO MILLSITE

The shallow aquifer underlying the Monticello, Utah, DOE property is also contaminated by uranium mill tailings. Montezuma Creek, which flows through the property, has frequently contained contamination at levels exceeding State of Utah water-quality standards for several kilometers downstream from the property. Contamination in the creek results from seeps issuing from the contaminated alluvial aquifer. This seepage causes the uranium concentration in the creek to increase by as much as an order of magnitude; concentrations as high as 0.9 mg/l were detected 30 meters from the Government property in

1984. Similarly, selenium concentrations regularly exceeded 0.01 mg/l, the Utah standard for this section of Montezuma Creek. Molybdenum concentrations, which average approximately 0.09 mg/l immediately downstream from the site, exceeded the recommended limit for agricultural use (National Academy of Sciences, 1972) by about a factor of ten. The creek is used both for irrigation and for livestock watering in the vicinity of the site. During 1985, observed concentrations of uranium, selenium, and molybdenum were lower; however, fewer samples were collected than in previous years and samples were collected when water in the creek was at relatively high levels, thereby diluting the contaminants.

Concentrations in the shallow aquifer generally exceed those found in the surface water. Uranium, molybdenum, vanadium, selenium, and arsenic are all found in concentrations exceeding 1 mg/l in some wells. However, because of the low volume of water in this aquifer, State of Utah standards are apparently not applicable.

Extensive measurements of radon contamination from the tailings piles were conducted during 1984 and 1985. These include on-pile, site-boundary, and offsite Track Etch measurements, as well as additional on- and off-pile radon-flux measurements. Results of these measurements, reported in the Draft Environmental Assessment of Remedial Action at the Monticello Uranium Mill Tailings Site, Monticello, Utah (Bendix Field Engineering Corporation, 1985), demonstrate that the EPA standard for radon emissions from inactive uranium processing sites is exceeded at all four tailings piles at the Monticello site.

**Section II**  
**INTRODUCTION**

This report describes environmental monitoring activities conducted at the U.S. Department of Energy (DOE) Grand Junction, Colorado, Projects Office facility (Section III) and at the inactive uranium millsite in Monticello, Utah (Section IV).

#### GRAND JUNCTION PROJECTS OFFICE FACILITY

The Grand Junction Projects Office (GJPO) facility encompasses 48.6 acres and lies on the floodplain of the Gunnison River. An earthen dike is located between the facility and the river to the west. Although adjacent land is used primarily for agriculture, the facility is within approximately 1 kilometer of heavily populated areas.

Personnel at the GJPO facility develop, support, and/or administer a variety of programs. Historically, the Office was most heavily involved in uranium procurement, evaluation of domestic uranium resources, and advancement of geologic and geophysical exploration techniques. The scope of activities now includes provision of considerable support to the Government's various remedial action programs and to the Civilian Radioactive Waste Management (CRWM) program. Housed on the GJPO facility are fully equipped laboratories for analytical chemistry, mineralogy-petrology, and electronics. Research groups at the facility have also received funding for specific projects from a variety of entities, including the Environmental Protection Agency and the Department of Defense. Bendix Field Engineering Corporation (Bendix) is the operating contractor for the Government-owned/contractor-operated (GOCO) facility.

No point-source discharges or waste-treatment activities occur on the facility. Uranium milling, analysis, and storage were conducted for a period of 25 to 30 years; these activities ceased in the mid-1970s. All present contamination is believed to be the result of these past activities. According to historical records (those maintained by the Department of Energy and its predecessor agencies, the Atomic Energy Commission and the Energy Research and Development Administration), approximately 32,000 tons of ore were processed. Most of the resulting tailings are buried in the 'Tailings Area' (see Section III). In addition, approximately 25,000 cubic yards of contaminated material were used as backfill around the dike that separates the GJPO facility from the Gunnison River. Each of five other locations contains contaminated material in amounts ranging from 1000 to 6000 cubic yards, while several miscellaneous locations account for an additional 1000 cubic yards (Henwood and Ridolfi, 1986).

Cleanup of the buried mill tailings at the GJPO facility has been accepted under the Surplus Facilities Management Program (SFMP). Funding for this effort began in FY-1985.

#### MONTICELLO, UTAH, MILLSITE

Responsibility for administration, maintenance, and environmental monitoring of the inactive uranium millsite and tailings area at Monticello, Utah, formerly operated by the Atomic Energy Commission, resides with the DOE Grand Junction Projects Office. The site was accepted into the Surplus Facilities

Management Program in 1980. Under this program, the chief objective of the Monticello Remedial Action Project is to minimize potential health hazards to the public associated with the tailings at the millsite. In order to provide a basis for making remedial action decisions regarding the site, an environmental and engineering characterization was completed and documented in the Monticello Remedial Action Project Site Analysis Report (Abramiuk and others, 1984).

The Monticello millsite is a 78-acre tract located in San Juan County, Utah, adjacent to the city limits of Monticello. The mill area covers approximately 10 acres and the tailings impoundment area covers the remaining 68 acres. None of the original mill buildings remain, but contaminated foundations and scrap materials are buried on site. The tailings impoundment area contains almost 2 million tons of tailings and contaminated soil in four separate tailings piles. Results of additional surveys indicate the presence of more than 300,000 additional tons of contaminated material on adjacent open lands (Marutzky and others, 1985).

Prior to 1955, the environmental problems receiving attention at the Monticello mill arose from the salt-roast procedure used to enhance vanadium recovery. Studies indicated that an average of nearly 2600 pounds of dust containing 0.363 percent  $U_3O_8$  and 1.52 percent  $V_2O_5$  escaped daily through the roaster stack (Allen and Klemenic, 1954). Corrosion of wire fences, clothes-lines, and galvanized roofs was verified by the mill operator in response to complaints from local residents.

Liquid effluent from the salt roast/carbonate leach plant, containing substantial concentrations of chloride, sulfate, carbonate, bicarbonate, sodium, and other dissolved species, was released into Montezuma Creek. Release of radium-226 was of special concern; soluble radium activity in Montezuma Creek was found to be 160 pCi/l. It was also recognized that the suspended solids contained considerable radium activity and that dry tailings were being washed into the creek (Whitman and Beverly, 1958).

During milling operations, the tailings were normally moist so that erosion by wind was minimal. Within a year after shutdown, however, the tailings dams and surfaces of the piles dried out, and tailings sand began to migrate as dunes. Erosion by water also became a problem. Several cleanup activities, conducted since the time of mill closure, have substantially stabilized the area, but have not eliminated water contamination.

Water contamination results from the leaching of the uranium mill tailings. Extensive studies conducted at Monticello (Abramiuk and others, 1984) demonstrate that all four tailings piles contribute to the contamination of groundwater and surface water, both on and off site.

#### QUALITY ASSURANCE

Quality Assurance (QA) measures were incorporated into all of the monitoring activities detailed in this report, and were appropriately documented. The general quality assurance policy and procedures, as presented in the Quality Assurance Manual (Bendix Field Engineering Corporation/Grand Junction Operations), were followed. In addition, certain documents were consulted to

address QA considerations regarding specific measurement and sample-collection procedures. These include the following:

- DOE/GJPO Handbook of Analytical and Sample-Preparation Methods (Bendix Field Engineering Corporation)
- DOE/GJPO Administrative Plan and Quality Control Methods for the Bendix/GJO Analytical Laboratories (Bendix Field Engineering Corporation)
- Bendix/GJO Environmental Sciences Procedure Manual: Second Edition (Bendix Field Engineering Corporation)

Specific QA requirements for each project have been defined and were compiled as the following documents:

- SFMP/Grand Junction Projects Office (GJPO) Quality Assurance Program Plan (QAPP)
- SFMP/Monticello Remedial Action Project (MRAP) Quality Assurance Program Plan (QAPP)

**Section III**

**GRAND JUNCTION, COLORADO, PROJECTS OFFICE FACILITY**

## AIR QUALITY

No air-quality monitoring activities were conducted at the GJPO facility in 1985. The 1980 and 1981 environmental monitoring reports (Korte and Thul, 1981, 1982) describe air-quality impacts from the sample plant, analytical laboratory, employee automobiles, and the central heating plant. It was concluded that no impacts were observed or expected. Monitoring for airborne particulates was initiated at three locations in December 1985. These data will be used to assess the impacts of various remedial action scenarios. Preliminary data will be available for the 1986 Environmental Monitoring Report.

Other operations at the GJPO facility do not emit significant quantities of radiation into the atmosphere. The tailings buried on the facility constitute the only major source of radon emission. A Track Etch monitoring system was established in November 1984 to determine the radon contribution from the facility. Four sets of samples were collected on a quarterly basis. These data are being accumulated for an environmental assessment and will not be available in final form until mid-1986. Preliminary results, however, indicate that Environmental Protection Agency (EPA) radon standards are exceeded at one of eight edge-of-facility locations.

## POLYCHLORINATED BIPHENYL (PCB) MONITORING

During 1982 a program was completed to identify and determine the total quantity of polychlorinated biphenyls (PCBs) and PCB-contaminated fluids on the facility. All facility transformers were opened and oil samples taken. These samples were analyzed in the Bendix Analytical Chemistry Laboratory, based on methods and standards provided by the Environmental Protection Agency. More than 1000 gallons of PCB-contaminated fluids were identified (Miller and Donovan, 1982). All PCB-contaminated labware and waste material (approximately 20.5 pounds) were disposed of during 1983.

## WATER QUALITY

### SAMPLING PROCEDURES

Water samples were collected at the GJPO facility in November 1984, and in February, May, and October 1985. (For the purposes of this report, these are referred to as the four 1985 samplings.) Both groundwater and surface-water samples were obtained using a peristaltic pump. Samples were filtered through a 0.45- $\mu$ m filter in line with the collection vessel. The samples were then preserved and analyzed according to procedures prescribed in Korte and Ealey (1983), Korte and Kearn (1985), and Bendix Field Engineering Corporation (undated). These procedures incorporate the major aspects of procedures published by the U.S. Environmental Protection Agency (1979a, 1979b, 1980, 1982a, 1982b) and the U.S. Geological Survey (1977). However, they provide much greater detail and include extensive quality-assurance measures.

## SURFACE WATER

Figure III-1 shows the surface water sites that were routinely sampled during 1985. The North Pond is contaminated principally by uranium; recharge is primarily from the shallow gravel aquifer underlying the facility. Contamination levels are similar to those observed in previous years. Uranium concentrations in the four 1985 samplings averaged nearly 0.7 mg/l.

The South Pond ('Lagoon' on Figure III-1), also recharged primarily by the shallow gravel aquifer, was formerly used as a sewage lagoon. Currently, its principal source of effluent is storm runoff from the parking lots. Variable contamination by uranium has been observed: The sample collected in November 1984 contained 0.2 mg/l; the February 1985 sample contained only 0.02 mg/l; while the May 1985 sample contained 0.35 mg/l. This last value decreased to 0.009 mg/l by the time of the October sampling. These fluctuations are clearly related to water levels in the alluvium; that is, high water levels coincide with higher uranium concentrations in the lagoon.

Previous environmental monitoring reports refer to a sampling location known as the drainage ditch. This area is located outside the facility fence directly west of the buried tailings area ('Tailings Area' on Figure III-1) and below the river dike. Formerly, the South Pond overflowed into the ditch more or less continuously; however, it has been observed on numerous inspections that the pond has not contained sufficient water to overflow since the facility was connected to the city sewer system in 1981. Nevertheless, water remains in the ditch area except during very dry seasons. Results of chemical analysis of the ditchwater indicate that radium-226 concentrations averaged 46 pCi/l in 1984 and were as high as 50 pCi/l in 1985. Concentrations of uranium and molybdenum were also high, the former exceeding 3 mg/l and the latter exceeding 1.0 mg/l in the October sampling.

The Gunnison River was sampled upstream, downstream, and alongside the facility during each of the four sampling periods in 1985. Five additional river samples were collected alongside a portion of the dike now known to be contaminated (Henwood and Ridolfi, 1986). Uranium-related contaminants were not detected in any of these samples, nor were significant differences in the three locations noted for any of the sampling periods. Slight increases for a few species are evident, but the differences are not sufficient to suggest contamination from the site.

The level of water in the ditch rises and falls with the level of water in the river; thus, there is a strong likelihood that contaminated water enters the river. Apparently, the volume of water in the river is sufficient to quickly dilute contaminants to background levels. The 1981 Environmental Monitoring Report (Korte and Thul, 1982) describes some weak evidence for river contamination; this is explained in part by the lower average flows in the river in 1981 relative to 1985. River flows in cubic feet per second for the 1985 samplings were 1035, 2577, 7955, and 2225 for November, February, May, and October, respectively.

An additional problem in assessing possible contamination of the Gunnison River results from the method used for sample collection. All the river samples have been 'grab' samples collected from the riverbank; yet studies

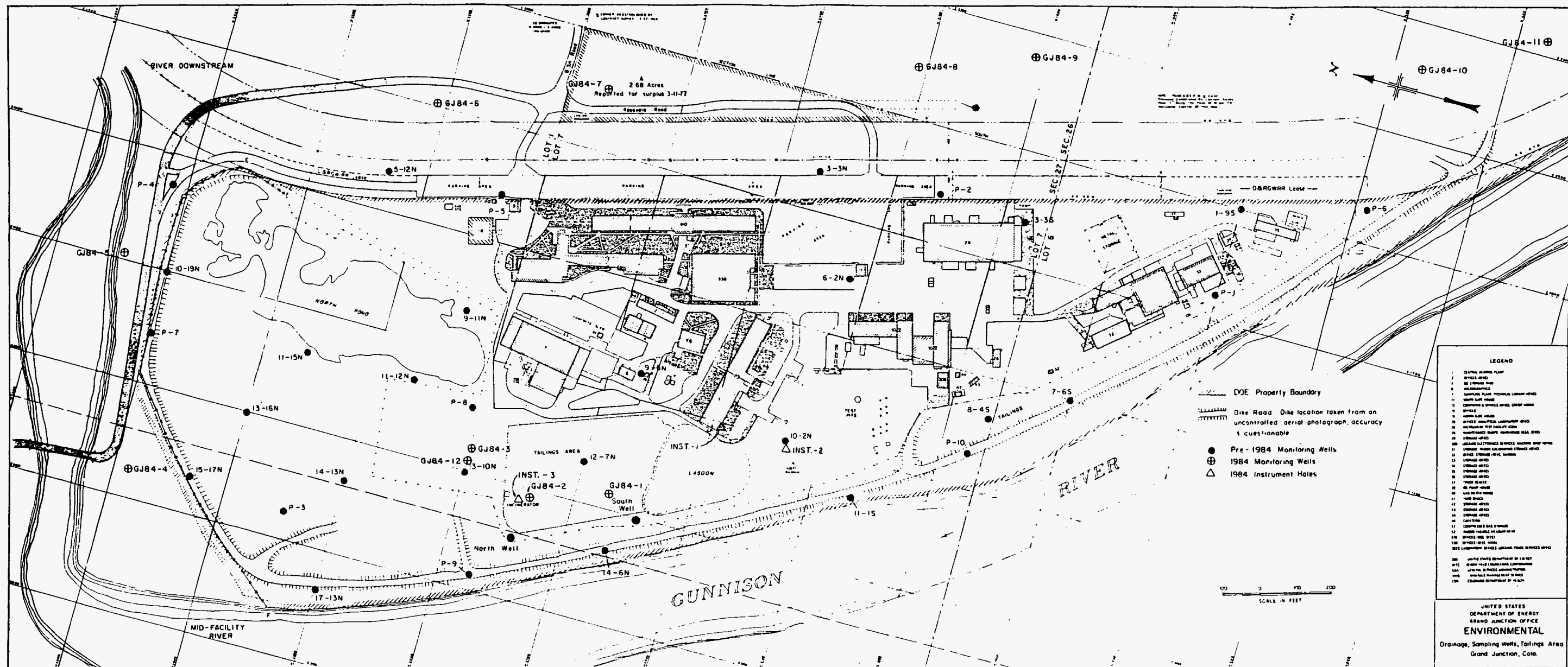


Figure III-1. Map of the GJPO Facility Showing Locations of Buildings, Pertinent Areas, and Monitoring Wells

demonstrate that this type of sample does not yield an accurate picture of the concentration of material in a river (see, for example, Jaffe and others, 1982). A more extensive sampling study may be conducted in order to determine whether the river is affected by contaminants leaching from the GJPO facility.

## GROUNDWATER

Analytical results on samples collected from the groundwater monitoring wells are also described empirically. Quantitative interpretation of the data using computer modeling is currently under way; results will be presented in an Environmental Assessment scheduled for completion in FY-1987.

Based on results of the 1981 data, Wells P-2, P-6, 1-9S(D), 3-3N(D), and 5-12N(D) (Figure III-1) were expected to represent background. (The designation 'D' denotes a two-well multilevel system at the particular location.) Results of subsequent samplings, however, indicate that this assumption is erroneous. Uranium levels in Wells P-2 and P-6 reported in the 1981 report were less than 0.01 mg/l. During each of the succeeding years (1982 through 1985), samples from all five wells contained levels of uranium above the expected background concentration. Uranium contents ranged from approximately 0.02 mg/l in Well 3-3N(D) to 0.7 mg/l in the shallow well at location 1-9S. Except for Well 1-9S(D), the concentration of uranium ranged from 0.02 to 0.09 mg/l. Other anomalies also exist. For example, selenium was detected in Wells 5-12N(D), 1-9S(D), P-2, and 3-3N(D); contamination by zinc, vanadium, and manganese is evident in one or more wells. As a consequence, it became clear that none of these five wells represents background. For that reason, additional wells were drilled in 1984 (Sewell and Price, 1984); they are denoted by the prefix GJ84-. Data from five samplings of Wells GJ84-9, -10, and -11 indicate that average concentrations of uranium, arsenic, selenium, and molybdenum in these wells are all less than 0.01 mg/l.

The discussion that follows focuses on individual contaminants (cf. Figure III-1 for location information).

Uranium contamination is evident in all wells except those new wells that represent background (GJ84-9, -10, and -11) and GJ84-1. Thirty-one wells contained more than 0.5 mg/l uranium in at least one of the sampling periods. The highest concentrations were found in Wells 8-4S, P-10, and 7-6S, which are located west of Building 3022. Similar concentrations, 2.0 mg/l or greater, were found in Well 10-2N, located south of Building 20, and in Well 11-15N which lies along the west bank of the North Pond. The uranium levels in most of the other wells were greater than 0.1 mg/l. The average concentration in the wells along the north dike has remained fairly constant over the past 4 years. Average uranium concentrations of 0.81 mg/l in 1982, 0.88 mg/l in 1983, 0.86 mg/l in 1984, and 0.92 mg/l in 1985 were determined from data for Wells P-4, 10-19N, P-7, and 15-17N; data from Wells GJ84-4 and -5 were included in the 1984 and 1985 averaging. The uranium concentrations along the west boundary (Wells 11-1S, P-10, 7-6S, and 8-4S) were at least 1.3 mg/l in each of the four sampling periods in 1985, with a high value of 2.6 mg/l. Several of these wells are located on the river dike.

Molybdenum contamination is also widespread throughout the monitoring system. The highest concentration in 1985 occurred in Well 8-4S, exceeding 2.0 mg/l on two occasions. Several other wells (10-2N, P-1, 13-16N, 13-10N, P-10, and GJ84-12) consistently averaged greater than 0.4 mg/l throughout the year.

Arsenic contamination is localized in the vicinity of the buried tailings area. The highest concentrations, ranging from 0.24 to 0.46 mg/l, were found in Wells 14-6N, GJ84-2, GJ84-1, and the North Well. The average annual arsenic levels for other wells in this vicinity (GJ84-12, 13-10N, 12-7N, and the South Well) ranged from 0.04 to 0.16 mg/l. Well GJ84-12 was the only well near the buried tailings area that consistently contained less than 0.1 mg/l arsenic.

Selenium contamination appears to be greatest in the south end of the facility. Data from Wells 3-3S, 10-2N, 6-2N, 1-9S, 8-4S, 7-6S, and P-1 indicate average concentrations of 0.05 mg/l in November, 0.06 mg/l in February, 0.16 mg/l in May, and 0.02 mg/l in October.

Although the potential for radium contamination is a concern due to the nature of the buried waste, the conditions of high pH, high sulfate, and low barium in the alluvial aquifer lead to little or no radium migration. In fact, detection of radium was limited to the following locations during the 1985 samplings: the dike ditch for each sampling, Well 13-16N in February and October, and the lagoon in October.

The drinking-water standard for nitrate-nitrogen is 10 mg/l, and several wells contained concentrations exceeding this limit. All of these wells are located roughly between Wells 1-9S (east of Building 34) and 11-12N(D) (near the North Pond). None of the perimeter wells contains high levels of nitrate.

#### RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) MONITORING

The quarterly groundwater monitoring program conformed to the requirements of the Resource Conservation and Recovery Act (RCRA) as presented in 40 CFR Part 265.93. Well GJ84-9 was used as a background well, while Wells GJ84-4, GJ84-5, GJ84-8, 10-19N, 13-16N, 15-17N, and 17-13N were used as downgradient wells. Well construction and installation conformed to the requirements of 40 CFR Part 265.91 (Sewell and Price, 1984). Results of the RCRA compliance monitoring at the Grand Junction site are presented in Appendix A.

Results of statistical analyses required by 40 CFR Part 265.94 and Appendix IV to Part 265 are presented in Table III-1. The results demonstrate that concentrations of total organic carbon are significantly greater than background for Wells GJ84-4, GJ84-5, 13-16N, 15-17N, and 17-13N. Furthermore, Well 13-16N also contains significantly greater concentrations of total organic halogen and significantly higher specific conductance. These results may be explained by burials of uraniferous lignite which occurred in the vicinity. One goal of the 1986 samplings will be to identify the specific organic contaminants in order to more fully assess the nature and extent of this contamination.

**Table III-1. Statistical Results on RCRA Indicators of Groundwater Contamination at the Grand Junction Site<sup>a</sup>**

Well	Comparison	pH	Specific Conductance <sup>b</sup>	Total Organic Carbon <sup>c</sup>	Total Organic Halogen <sup>d</sup>
Background Well GJ84-9	Mean	8.00	2,193.75	1.64	65.13
	Variance	0.42	53,468.92	0.32	10,019.58
	t-test	---	---	---	---
	Critical t	---	---	---	---
	Finding	---	---	---	---
Downgradient Well GJ84-4	Mean	7.20	4,178.00	6.42	57.00
	Variance	0.00	315,218.00	0.62	2,247.71
	t-test	2.47	4.80	13.26	-0.27
	Critical t	4.60	6.71	3.05	2.68
	Finding	NS	NS	Significant	NS
Downgradient Well GJ84-5	Mean	7.40	4,155.00	9.45	356.38
	Variance	0.08	13,056,050.00	26.17	134,762.84
	t-test	-1.58	0.77	3.73	2.20
	Critical t	6.07	9.91	3.14	2.89
	Finding	NS	NS	Significant	NS
Downgradient Well GJ84-8	Mean	7.70	3,487.50	4.73	13.00
	Variance	0.02	300,312.50	8.99	99.71
	t-test	0.89	3.20	2.50	-2.06
	Critical t	5.07	9.42	3.14	2.59
	Finding	NS	NS	NS	NS
Downgradient Well 10-19N	Mean	7.23	8,062.50	54.57	121.75
	Variance	0.01	1,487,812.50	1,248.59	6,317.64
	t-test	-2.39	6.74	3.67	1.51
	Critical t	4.63	6.91	3.14	2.76
	Finding	NS	NS	NS	NS
Downgradient Well 13-16N	Mean	6.90	8,475.00	75.58	215.50
	Variance	0.02	151,250.00	2,300.43	3,077.43
	t-test	-3.24	90.79	20.87	4.73
	Critical t	4.20	6.59	3.14	2.09
	Finding	NS	Significant	Significant	Significant

<sup>a</sup>A finding of Significant indicates that the parameter is not in compliance. A finding of Not Significant (NS) indicates that there is no evidence to refute compliance.

<sup>b</sup>Mean result given in units of  $\mu\text{mhos/cm}$ .

<sup>c</sup>Mean result given in  $\text{mg/l}$ .

<sup>d</sup>Mean result given in  $\mu\text{g/l}$ .

Table III-1 (continued). Statistical Results on RCRA Indicators of Ground-water Contamination at the Grand Junction Site<sup>a</sup>

Well	Comparison	pH	Specific Conductance <sup>b</sup>	Total Organic Carbon <sup>c</sup>	Total Organic Halogen <sup>d</sup>
Downgradient Well 15-17N	Mean	7.20	6,835.00	27.43	54.88
	Variance	0.00	4,712,449.99	54.01	562.98
	t-test	2.47	3.02	8.58	-0.39
	Critical t	5.84	6.95	3.14	2.62
	Finding	NS	NS	Significant	NS
Downgradient Well 17-13N	Mean	7.30	1,052.50	10.75	151.75
	Variance	0.02	43,512.50	2.03	24,490.21
	t-test	-2.06	-6.09	15.08	1.43
	Critical t	5.07	5.74	3.11	2.84
	Finding	NS	NS	Significant	NS

<sup>a</sup>A finding of Significant indicates that the parameter is not in compliance. A finding of Not Significant (NS) indicates that there is no evidence to refute compliance.

<sup>b</sup>Mean result given in units of  $\mu\text{mhos/cm}$ .

<sup>c</sup>Mean result given in mg/l.

<sup>d</sup>Mean result given in  $\mu\text{g/l}$ .

#### COLORADO WATER-QUALITY STANDARDS

State of Colorado water-quality standards, as specified in the Colorado Water Quality Control Act, were reviewed with respect to contamination detected on the GJPO facility. Table III-2 presents the range of numerical standards for some of the contaminants found in the underlying gravel aquifer. There is no Colorado standard for molybdenum; however, the National Academy of Sciences (1972) has recommended an agricultural-use standard of 0.01 mg/l.

Table III-2. Colorado Water-Quality Standards for Selected Elements

Element	Maximum Contaminant Level (depending on use class and alkalinity)
Arsenic	0.05 - 0.1 mg/l
Selenium	0.01 - 0.05 mg/l
Uranium	0.03 - 1.4 mg/l
Radium-226 and -228	5.0 pCi/l

As the table demonstrates, application of these standards is complicated by the promulgation of varying contaminant levels for many trace elements, the applicable standard being dependent on the use classification and alkalinity of the water. The thrust of the Colorado statute is to clean up existing polluted waters and to prevent further degradation of any State waters. The shallow gravel aquifer underlying the GJPO facility is contaminated at levels that make it unfit for agricultural purposes, the lowest use class defined. However, the language in the Act seems to exempt past practices. In other words, since the shallow aquifer is not being used for any purpose, it may be interpreted that the Department of Energy is not mandated to clean it up. On the other hand, existing operations are not permitted to cause further degradation.

Contamination of the Gunnison River is another matter. The regulations clearly prohibit any facility from degrading the quality of a State river. Hence, it is important to know how much contaminated water enters the river and whether the levels are increasing or decreasing. These questions will be answered through additional hydrologic testing and geochemical modeling as part of the SFMP project.

**Section IV**

**MONTICELLO, UTAH, MILLSITE**

## WATER QUALITY

### SAMPLING PROCEDURES

Groundwater and surface-water samples were collected at the Monticello site in April, June, and October of 1985 using a peristaltic pump, a bladder pump, or a Teflon bailer. Samples requiring filtration were filtered through a 0.45- $\mu$ m filter in line with the collection vessel. The samples were then preserved as required and analyzed according to procedures prescribed in Korte and Ealey (1983), Korte and Kearn (1985), and Environmental Protection Agency (EPA) standards (U.S. Environmental Protection Agency, 1979a, 1979b, 1980, 1982a, 1982b).

### SURFACE WATER

#### Characterization of Background

Background surface-water quality has been monitored for some years at the site labeled W-3 in Figure IV-1. This sampling point is located east of the culvert under U.S. Highway 163. Upstream samples (site I-1) have also been collected to verify that the W-3 site accurately represents the background water quality of Montezuma Creek (Korte and Thul, 1982, 1983).

In all three 1985 samplings, surface water at site W-3 was characterized by low levels of toxic elements or mill-tailings-related contaminants. Elements not detected or found in very low concentrations include As, Ba, Cr, Fe, Mn, Mo, Pb, Se, U, V, and Zn. No Ra-226 was detected. The pH was between 7.4 and 8.6; specific conductance ranged from 240 to 405  $\mu$ mhos/cm, and alkalinity from 139 to 181 mg/l (as  $\text{CaCO}_3$ ).

#### Surface Water Contamination

Permanent surface water on the Government property consists of perennial flow in Montezuma Creek and in the drainage between the carbonate and vanadium piles (drainage designated W-2 on the map in Figure IV-1). There is intermittent water in seeps south of the carbonate and vanadium piles and east of the acid pile. The vanadium and acid pile seeps contain water in the Spring due to the melting of snow. The seep adjacent to the vanadium pile generally covers an area up to 5 square meters to a depth of 15 to 30 centimeters. The acid pile seep is contained by a small dam and, when full, is approximately four times larger in area than the vanadium pile seep.

The seep adjacent to the carbonate pile forms a small pond covering approximately 15 square meters. This pond contains water throughout the Summer and supports a few cattails; typically it is the only one of the three seeps that contains water during the dry seasons.

A diversion ditch was constructed north of the east tailings pile in 1984 with a view to diverting some water away from the piles and thereby decreasing the volume of contaminated water that seeps out of the piles. Visual observations

during 1985, however, did not indicate any decrease in water in the various seeps and small drainages that surround the piles. All sampling trips, however, coincided with periods of rainfall.

Sampling of all three seeps was conducted during April 1985. The acid pile seep contained 1.7 mg/l U, 1.5 mg/l Mo, and 16.8 mg/l V. The carbonate pile seep contained 0.9 mg/l U, 0.7 mg/l Mo, and 9.3 mg/l V. The vanadium pile seep contained 36 mg/l U, 5.2 mg/l Mo, and 352 mg/l V. Subsequent samplings of the carbonate pile seep (June and October) and the vanadium pile seep (October) yielded similar results.

Montezuma Creek flows through the middle of the property. As mentioned earlier, flow is perennial, although it can be quite low during the late Summer. There can also be substantial flooding with high flows, as was observed in the Spring of 1983. Results of previous studies (Korte and Thul, 1982, 1983) indicate that uranium contamination of the creek is observed prior to the point at which the creek traverses the tailings piles. However, concentrations of both molybdenum and uranium are typically higher off site, demonstrating that contributions from the alluvial aquifer to Montezuma Creek occur to the greatest extent downstream from the Government property.

#### Montezuma Creek

Seeps from the shallow aquifer are visible along the creek below the drop structure. Creek flow increases for approximately 2 kilometers and is perennial along this stretch. The W-4 sampling site is located approximately 100 meters downstream from the east boundary of the property. Except under conditions of very high flow, as during a storm event or Spring runoff, contamination levels frequently exceed State of Utah standards (for further discussion, see the section entitled Water-Quality Standards).

Samples have routinely been collected at what is known as the Sorenson site, located approximately 2 kilometers downstream from the Government property. It has been apparent from data comparison that little decrease in contamination is observed between the W-4 site and the Sorenson site. The shallow aquifer is contaminated as far downstream as it has been sampled, and thus maintains high concentrations (0.12 mg/l U and 0.42 mg/l V) of the toxic elements in Montezuma Creek for a considerable distance off site. The downstream water quality of Montezuma Creek is described in detail in the 1983 Environmental Monitoring Report (Korte and Thul, 1984).

#### GROUNDWATER

##### Alluvial Aquifer Upgradient

Shallow-aquifer background groundwater-quality data have been acquired from Wells 19, 44, 43, and 20 (see Figure IV-2). Elements not detected or found in very low concentrations include As, Ba, Cl, Fe, Mo, Pb, Se, V, Zn, and Ra-226. Trace elements found in significant concentrations include Mn (0.1 to 1.0 mg/l) and U (as much as 0.05 mg/l). The pH ranged from 6.0 to 7.6, specific conductance from 810 to 1056  $\mu$ mhos/cm, and alkalinity from 269 to 339 mg/l.

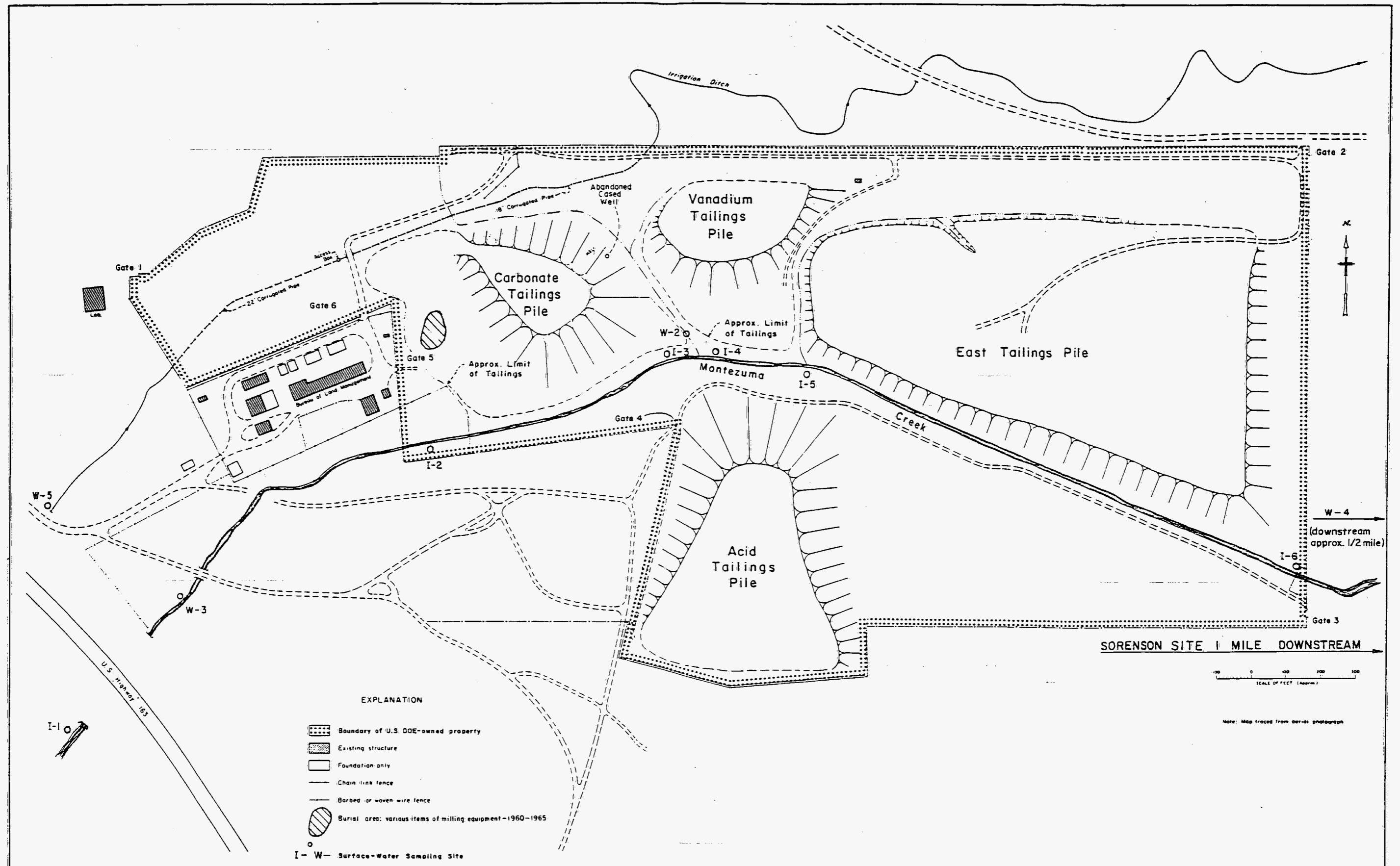
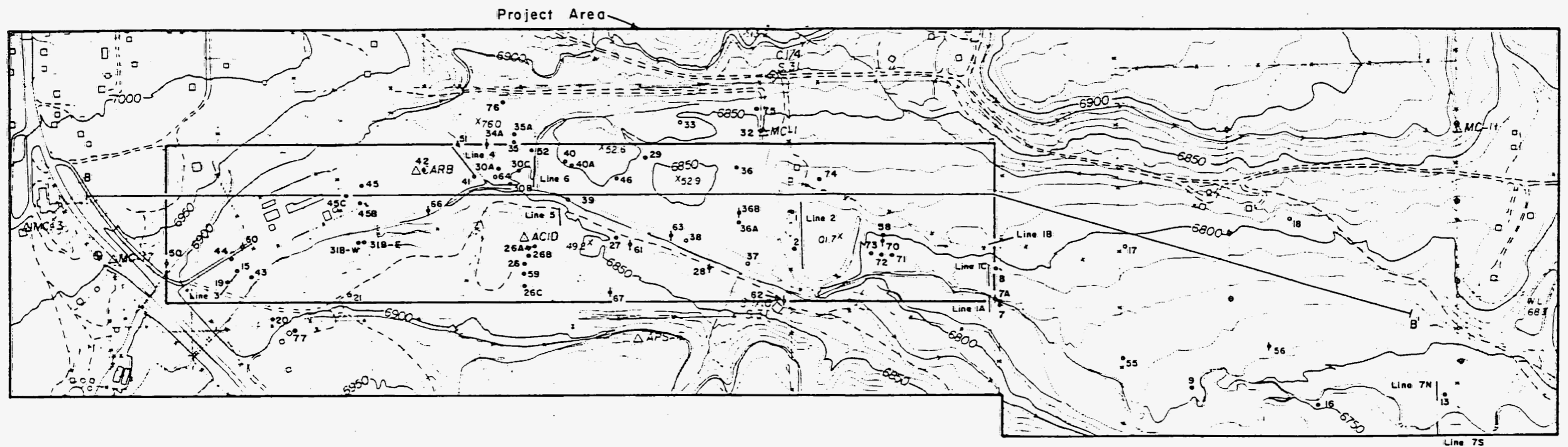


Figure IV-1. Sampling Locations for Surface Water at the Monticello Millsite



- EXPLANATION**
- B-B' Generalized Cross Section
- Line 1 / Seismic-Refracton Line
- Drill Hole
- ◊ Core Hole
- Abandoned Drill Hole

Figure IV-2. Locations of Groundwater Monitoring Wells at the Monticello Millsite

### Alluvial Aquifer On Site

The shallow aquifer is contaminated by the mill-tailings piles (Table IV-1). In general, the highest concentrations are found in the vicinity of the carbonate and vanadium piles. Note that the high uranium content of Well 36A on the east side of the east tailings pile is reflected in offsite Well 1 on the private property immediately east of the Government property (Table IV-2).

Table IV-1. Contamination in Shallow Onsite Monitoring Wells

Well	Contaminant Concentration <sup>a</sup>										
	As	Cl	Fe	Mn	Mo	NO <sub>3</sub> -N	<sup>226</sup> Ra	Se	SO <sub>4</sub>	U	V
30A	0.02	45	0.09	2.27	0.05	<0.23	-	0.013	351	0.2	0.75
30B	0.19	124	<0.03	2.61	0.48	0.23	-	0.16	534	0.7	4.7
30C	0.13	102	<0.1	1.92	0.34	0.45	<1	0.11	470	0.4	4.2
36A	<0.01	99.5	<0.1	15.3	1.36	23.6	28	<0.01	3600	11.2	<0.05
40A	0.07	101	0.29	3.01	0.34	<0.23	5.3	<0.01	592	1.1	0.47
41	2.4	1520	0.03	0.43	8.02	141	-	2.8	3730	2.5	122
45B	<0.01	14.9	0.2	0.17	<0.05	0.56	-	<0.005	238	0.02	<0.05

<sup>a</sup>All results are in mg/l except those for Ra-226 which are in pCi/l. Results represent averages for three samplings made over the period April to October 1985.

Table IV-2. Contamination in Shallow Offsite Monitoring Wells

Well	Contaminant Concentration <sup>a</sup>								
	As	Fe	Mn	Mo	NO <sub>3</sub> -N	<sup>226</sup> Ra	Se	U	V
1	0.04	<0.1	3.63	0.36	1	<1	<0.01	2.0	0.91
7	<0.01	0.1	<0.05	<0.05	1.9	<1	0.04	0.4	0.08
8	<0.01	0.05	<0.05	<0.05	0.23	<1	0.01	0.1	<0.05
58	0.01	<0.1	0.16	<0.05	1.4	-	0.03	0.4	0.36
9	<0.01	0.09	1.16	0.09	<0.23	-	<0.005	0.5	<0.01
13	<0.01	0.21	0.11	<0.05	<0.23	-	<0.005	0.6	<0.05

<sup>a</sup>All results are in mg/l except those for Ra-226 which are in pCi/l. Results represent averages for three samplings made over the period April to October 1985.

### Alluvial Aquifer Downgradient

The shallow-aquifer monitoring wells on the private property east of the Government property are contaminated with uranium, molybdenum, vanadium, and selenium. The data presented in Table IV-2 demonstrate that concentrations of these elements remain high throughout the year. This aquifer is the major water source for the creek during the dry months, often causing the creek to maintain relatively high levels of contamination during those periods. Two of these wells, 9 and 13, are located as far east of the Government property as 1 kilometer and are still significantly contaminated (Table IV-2).

### Resource Conservation and Recovery Act (RCRA) Monitoring

The quarterly groundwater monitoring program conformed to the requirements of the Resource Conservation and Recovery Act (RCRA) as specified in 40 CFR Part 265.93. This monitoring program encompassed both the upper contaminated alluvial aquifer and the lower Burro Canyon Formation aquifer. Well 20 was used to sample background in the alluvial aquifer, while the downgradient alluvial wells were 1, 36A, and 40A. In the Burro Canyon, Well 77 was used as the background well, while the downgradient wells were 74, 75, and 76. Construction and installation of these wells conformed to the requirements of 40 CFR Part 265.91.

Results of the RCRA compliance monitoring at the Monticello site are presented in Appendix B. Levels of total organic halogen in November 1984 in background wells 20 and 77 are 3 to 5 orders of magnitude higher than in any other sampling period. This is believed to be due either to laboratory error or sample contamination. Hence, the statistical analysis of the data required by 40 CFR Part 265.94 and Appendix IV to Part 265 will not be performed until an additional data set is obtained. The results of that analysis will be presented in the 1986 Environmental Monitoring Report.

### WATER-QUALITY STANDARDS

The Surplus Facilities Management Program Office has directed that the following standards will apply to the surface-water and groundwater quality at Monticello (White, 1983):

- EPA Standards for Remedial Actions at Inactive Uranium Processing Sites (40 CFR Part 192)
- EPA Safe Drinking Water Act (40 CFR Parts 141, 142, and 143)

In addition, Executive Order 12088 mandates that Federal Government facilities comply with State standards. Thus, the Utah Water Pollution Control Act (1978) must also be addressed with respect to remedial action at the Monticello site.

## Surface Water

According to the Utah Water Pollution Control Act, Montezuma Creek must be protected for domestic use (class 1C), aquatic life (class 3A), and agricultural use (class 4). The domestic-use classification is a result of drinking water being removed from the San Juan River at the town of Mexican Hat (Reichert, 1983); Montezuma Creek is a tributary of the San Juan.

Table IV-3 compares the average concentrations of the suspected hazardous contaminants found in Montezuma Creek with the applicable water-quality standards. Numerical standards have not been promulgated for some of the elements; thus, the potential violation of Utah's aquatic-life and agricultural-use standards is open to interpretation.

Sampling was less frequent in 1985 than in previous years, and water levels were quite high during each sampling period. These factors are believed to be responsible for the lower contaminant concentrations found in the stream in 1985. A detailed discussion of potential health effects is included in the Draft Environmental Assessment for the Monticello Millsite (Bendix Field Engineering Corporation, 1985). The paragraphs that follow evaluate the concentrations of individual elements found in the surface water with respect to the relevant numerical standards.

Uranium - The State of Utah has established a standard of 15 pCi/l gross alpha for class 1C waters. Results of analyses of Montezuma Creek demonstrate that uranium is the only alpha emitter found in significant concentrations. Gross alpha, based only on the uranium contamination contributed by the piles, usually exceeds the standard by at least a factor of six for up to 10 kilometers downstream from the site. However, after approximately 6.5 kilometers, there is a natural contribution from the Morrison Formation.

Arsenic - Arsenic contamination has been detected as far downstream as the Sorenson site. However, no arsenic was detected in 1985.

Selenium - In previous years, selenium concentrations usually exceeded the standards for the first 3 kilometers downstream from the site. In 1985, selenium was not detected in any of the downstream samples.

Radium-226 - Radium-226 contamination has not been detected in any of the Montezuma Creek samples collected over the past year.

Molybdenum and Vanadium - Neither of these elements is subject to specific numerical standards. However, except during 1985, both have been found in concentrations which may impair agricultural use.

Others - No other inorganic species are found in concentrations exceeding applicable State or Federal standards.

## Groundwater

In general, contamination in the shallow aquifer is greater than that found in Montezuma Creek (cf. Tables IV-1 and IV-2). Thus, the water is probably unfit for agricultural use. According to the Utah Water Pollution Control Act

(1978), the class 1C designation applies if an aquifer contains 'a sufficient quantity [of water] to supply a public system.' Since all of the shallow wells yield only small amounts of water, the class 1C designation is not applicable to the shallow aquifer at Monticello.

Table IV-3. Comparison of Montezuma Creek Contamination and Relevant Water-Quality Standards

Source	Contaminant Concentration (mg/l) <sup>a</sup>							
	As	Fe	Mn	Mo	NO <sub>3</sub> -N	Se	U	V
<u>MONTEZUMA CREEK CONTAMINATION</u>								
Background (Site W-3)	<0.01	<0.1	<0.05	<0.05	<5	<0.01	0.06	<0.05
Site W-4	<0.01	<0.1	<0.05	<0.05	<5	<0.01	0.04	0.06
Sorenson Site	<0.01	<0.1	0.05	<0.05	<5	<0.01	0.05	<0.05
<u>WATER-QUALITY STANDARDS</u>								
Utah: Domestic Use (1C)	0.05	b	c	c	10	0.01	c	c
Utah: Aquatic Life (3A)	b	1.0	c	c	c	0.05	c	c
Utah: Agricul- ture (4)	0.1	b	c	c	c	0.05	c	c
Safe Drinking Water Act	0.05	c	c	c	10	0.01	c	c

<sup>a</sup>Results represent averages for samples collected during three monitoring trips over the period April through October 1985. Contaminant levels are lower than those seen in previous years due to less frequent sampling in 1985 and high water levels encountered during the sampling trips.

<sup>b</sup>Insufficient evidence to warrant establishment of a numerical standard; limits are assigned on a case-by-case basis (State of Utah, 1978).

<sup>c</sup>No legal guidance.

## Summary

During 1985, unlike the previous 4 years, State of Utah standards for surface water were not violated in Montezuma Creek as a result of contamination from the tailings piles. The shallow aquifer remains contaminated, but contains too little water to have any potential for beneficial use.

## AIR QUALITY

### RADON FLUX AND ATMOSPHERIC TRANSPORT

Extensive measurements of radon contamination from the tailings piles were conducted during 1984. These include on-pile, site-boundary, and offsite Track Etch measurements, as well as additional on- and off-pile radon-flux measurements. Results of these measurements are presented in detail in the Draft Environmental Assessment for the Monticello Millsite (Bendix Field Engineering Corporation, 1985). The data demonstrate that the EPA standard for radon emissions from inactive uranium processing sites is exceeded at all four tailings piles at the Monticello site.

### AIR PARTICULATES

The background particulate burden in the Monticello area can be inferred from information gathered at rural sites throughout the western United States (Flocchini and others, 1981; Hall, 1981; Korte and Moyers, 1978; Mesa County, Colorado, Health Department, 1979). In two of these studies (Flocchini and others and Mesa County, Colorado, Health Department), data were collected within 50 to 100 miles of Monticello. Results of all of the investigations demonstrate that the average particulate mass in western, rural, high-desert locations is 15 to 25  $\mu\text{g}/\text{m}^3$ . These studies agree that most of the particulate mass is soil material, with only minor contributions of anthropogenic origin. However, determination of contaminants related to uranium mill tailings was not addressed in any of these investigations.

Van De Steeg and others (1982) describe the concentration and distribution of radionuclides in airborne particulates from the Ambrosia Lake uranium district in New Mexico. Average concentrations at background locations were approximately 5 to 10  $\mu\text{g}/\text{m}^3$  of U-238 and 0.1 to 0.5 pCi/ $\text{m}^3$  of Ra-226. These values represent the closest approximation of a historical record for Monticello.

### Sampling Method and Results

Inhalable particulate samplers based on the design by Wedding (1982) were installed at the Monticello site. The samplers are Sierra-Anderson Series 300, equipped with constant-flow controllers, mechanical timers, and Series-320-size selective inlets. Flow-rate calibration is accomplished with a Kurz Model 341 electronic mass flowmeter.

Samplers were operated at 40 cubic feet per minute (cfm) for 24 hours, running midnight-to-midnight every sixth day. Sample-collection media are Whatman Number 41 cellulose filters.

Wind-rose data collected on site have clearly identified two principal wind vectors in the area, one to the east and one to the north. Thus, sampling stations were located along these two directions as well as at a background site.

The background site is located approximately 0.8 kilometer west of the City of Monticello near the pumphouse building for the city water supply. The intake port for this sampler is 3 meters above ground level. The area west of this site is mostly natural desert and mountainous terrain. There are no nearby industrial activities.

The east site is located on the eastern edge of the east tailings pile. The sampler was placed on a steel tower such that the intake was mounted approximately 3 meters above ground level.

The north site is located on the west side of the City of Monticello cemetery grounds. This location is 300 meters north of the tailings area at an elevation 100 meters above the piles. The sampler intake is 4 meters above ground level.

Air-particulate sampling for 1985 was initiated on 10 April. (Sampling had been suspended during the period November 1984 to March 1985 due to inclement weather.) Table IV-4 lists concentrations of selected elements averaged for the entire 6-month sampling period from April to October. The highest readings were obtained on 10 May 1985. These values are listed with the average values. There is very little difference between the background and east and north locations, although the north site does show slightly higher levels than the background site. Uranium, radium-226, and thorium-230 were not detected in any of the sampling periods. Additional cover on the piles, resulting from cleanup of Monticello vicinity properties, may have had some effect on the decrease of airborne contaminants observed during the 1985 monitoring season as compared with the higher 1984 values (Korte and Wagner, 1985).

Table IV-4. Concentrations of Selected Elements in Airborne Particulates

Element	Element Concentration <sup>a</sup>					
	East Site		North Site		Background Site	
	Average	May 10	Average	May 10	Average	May 10
Cu	0.006	0.006	0.006	0.032	0.006	0.009
Pb	0.007	0.006	0.007	0.011	0.005	0.009
V	0.003	0.002	0.002	0.003	0.001	0.002
Fe	0.363	0.55	0.385	0.643	0.271	0.619
K	0.274	0.48	0.238	0.625	0.273	0.578
Mn	0.007	0.014	0.007	0.017	0.009	0.017
U	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ra-226	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Th-230	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003

<sup>a</sup>Results are in  $\mu\text{g}/\text{m}^3$  except Ra-226 and Th-230 which are in  $\text{pCi}/\text{m}^3$ .

#### POTENTIAL HEALTH EFFECTS

Population dose commitments and potential toxic effects of nonradiologic contaminants associated with the Monticello site are discussed in the Draft Environmental Assessment for the Monticello Millsite (Bendix Field Engineering Corporation, 1985). Results indicate that detrimental radiologic health effects are indistinguishable from those resulting from background.

Although contaminant levels were low in 1985, there is some potential for toxic effects from nonradiologic contaminants in the shallow unconfined aquifer and in Montezuma Creek. However, there have been no incidents reported. The potential for toxicity was derived from a comparison of contaminant levels with recommended safe limits as published in the technical literature (e.g., National Academy of Sciences, 1972). For example, the molybdenum concentration in Montezuma Creek for the first 2 kilometers downstream typically exceeds suggested limits for dairy cattle intake and recommended limits for irrigation water. Selenium concentrations generally exceed the suggested limits for protection of dairy cattle and frequently exceed limits for irrigation water. Vanadium concentrations regularly exceed suggested limits for the protection of dairy cattle, aquatic life, and irrigation water. The suggested limits for beef cattle are also exceeded at times. Since the creek is used both for irrigation and for watering livestock, the potential for toxic effects merits further study.

#### CONCLUSIONS

Hydrologic conditions at Monticello result in the movement of contaminants into the underlying alluvial aquifer and downgradient from the tailings area. Remedial action will address the extensive contamination in Montezuma Creek. This contamination exceeds numerical standards set by the State of Utah and extends for at least 6.5 kilometers downstream from the millsite.

**Section V**  
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## Appendix A

### RESULTS OF RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) COMPLIANCE MONITORING AT THE GRAND JUNCTION PROJECTS OFFICE FACILITY

This appendix presents tabulated results of the 1985 quarterly groundwater monitoring program conducted at the Grand Junction Projects Office facility in response to requirements of the Resource Conservation and Recovery Act. Well numbers and designations as to background or downgradient are noted at the top of each table. Results are presented for November 1984, February 1985, May 1985, and October 1985. The data in each table are organized according to the RCRA parameters specified in 40 CFR Part 265.93. For the Groundwater Contamination parameters, four replicates of each sample must be analyzed according to the requirements of the Act; these are designated as 1, 2, 3, and 4 in the tables. Values for specific conductance are corrected to 25°C.

## WELL GJ84-9, BACKGROUND

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			8.9	8.0	7.4	7.7
2			8.9	8.0	7.4	7.7
3			8.9	8.0	7.4	7.7
4			8.9	8.0	7.4	7.7
Specific Conductance - 1	µmhos/cm		1968	2100	2196	2511
2	µmhos/cm		1968	2100	2196	2511
3	µmhos/cm		1968	2100	2196	2511
4	µmhos/cm		1968	2100	2196	2511
Total Organic Carbon - 1	mg/l		1.6	0.9	2.6	1.2
2	mg/l		1.8	1.0	2.3	1.3
3	mg/l		—	—	2.2	1.4
4	mg/l		—	—	2.2	1.2
Total Organic Halogen - 1	µg/l		17	<5	<5	243
2	µg/l		14	5	6	254
3	µg/l		20	6	<5	229
4	µg/l		26	<5	5	201
<u>Groundwater Quality</u>						
Chloride	mg/l		27	26	27	26
Iron	mg/l		<0.1	<0.03	<0.1	0.1
Manganese	mg/l		<0.05	0.21	0.42	0.45
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		476	430	432	445
Sulfate	mg/l		1100	1100	1100	1080
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	0.0002
Selenium	mg/l		<0.01	<0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.78	0.84	1.1	1.03
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.12	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		<15	<15	<23	34
Gross Beta	pCi/l		<50	<50	<12	<20
Radium-226	pCi/l		<2	1	<1	<1

**WELL GJ84-4, DOWNGRADIENT**

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.2	7.2	7.2	7.2
- 2			7.2	7.2	7.2	7.2
- 3			7.2	7.2	7.2	7.2
- 4			7.2	7.2	7.2	7.2
Specific Conductance - 1	µmhos/cm		4575	5000	3781	5375
2	µmhos/cm		4575	5000	3781	5375
3	µmhos/cm		4575	5000	3781	5375
4	µmhos/cm		4575	5000	3781	5375
Total Organic Carbon - 1	mg/l		7.4	—	6.0	7.5
2	mg/l		7.4	—	6.2	8.1
3	mg/l		—	—	5.6	7.2
4	mg/l		—	—	5.9	7.0
Total Organic Halogen - 1	µg/l		100	37	12	73
2	µg/l		100	41	13	81
3	µg/l		120	35	16	78
4	µg/l		81	39	14	81
<u>Groundwater Quality</u>						
Chloride	mg/l		190	250	150	211
Iron	mg/l		0.14	0.09	0.1	0.08
Manganese	mg/l		2.88	4.35	1.92	2.88
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		1152	1130	793	1110
Sulfate	mg/l		3000	3100	1800	2480
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	0.0002
Selenium	mg/l		<0.010	<0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.42	0.28	0.4	0.36
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	2.7
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.048	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		260	1100	497	450
Gross Beta	pCi/l		90	420	269	280
Radium-226	pCi/l		<2	<1	<1	<1

WELL GJ84-5, DOWNGRADIENT

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.2	7.3	7.6	7.3
2			7.2	7.3	7.6	7.3
3			7.2	7.3	7.6	7.3
4			7.2	7.3	7.6	7.3
Specific Conductance - 1	µmhos/cm		6710	6100	1600	8246
2	µmhos/cm		6710	6100	1600	8246
3	µmhos/cm		6710	6100	1600	8246
4	µmhos/cm		6710	6100	1600	8246
Total Organic Carbon - 1	mg/l		16.0	—	6.3	13.0
2	mg/l		16.1	—	6.4	12.9
3	mg/l		—	—	5.9	13.0
4	mg/l		—	—	6.0	12.4
Total Organic Halogen - 1	µg/l		610	28	8	163
2	µg/l		690	31	16	127
3	µg/l		750	30	13	107
4	µg/l		740	29	24	122
<u>Groundwater Quality</u>						
Chloride	mg/l		500	400	44	395
Iron	mg/l		0.26	0.13	<0.1	0.12
Manganese	mg/l		4.68	4.53	0.41	3.50
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		1616	1370	307	1340
Sulfate	mg/l		4500	3900	550	3550
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	0.0002
Selenium	mg/l		<0.01	0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.52	0.27	0.7	0.33
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<10
Gross Alpha	pCi/l		190	630	126	450
Gross Beta	pCi/l		100	260	65	280
Radium-226	pCi/l		<2	<1	<1	<1

## WELL GJ84-8, DOWNGRADIENT

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.8	7.8	7.6	7.6
2			7.8	7.8	7.6	7.6
3			7.8	7.8	7.6	7.6
4			7.8	7.8	7.6	7.6
Specific Conductance - 1	µmhos/cm		2706	3100	3188	3875
2	µmhos/cm		2706	3100	3188	3875
3	µmhos/cm		2706	3100	3188	3875
4	µmhos/cm		2706	3100	3188	3875
Total Organic Carbon - 1	mg/l		3.1	8.8	3.7	2.6
2	mg/l		3.3	8.4	4.1	2.9
3	mg/l		—	—	3.9	2.8
4	mg/l		—	—	3.7	2.9
Total Organic Halogen - 1	µg/l		340	6	<5	30
2	µg/l		300	<5	44	11
3	µg/l		300	<5	<5	21
4	µg/l		360	6	19	22
<u>Groundwater Quality</u>						
Chloride	mg/l		26	30	34	33
Iron	mg/l		<0.10	0.03	<0.1	<0.03
Manganese	mg/l		0.53	0.44	0.26	0.49
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		769	728	774	865
Sulfate	mg/l		1400	1500	1600	1630
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	<0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		1.73	1.49	1.4	1.43
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<10
Gross Alpha	pCi/l		<15	<25	<35	<50
Gross Beta	pCi/l		<50	<50	<12	<20
Radium-226	pCi/l		<2	<1	<1	<1

## WELL 10-19N, DOWNGRADIENT

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.1	7.25	7.2	7.2
2			7.1	7.25	7.2	7.2
3			7.1	7.25	7.2	7.2
4			7.1	7.25	7.2	7.2
Specific Conductance - 1	µmhos/cm		7440	7200	6100	8925
2	µmhos/cm		7440	7200	6100	8925
3	µmhos/cm		7440	7200	6100	8925
4	µmhos/cm		7440	7200	6100	8925
Total Organic Carbon - 1	mg/l		20.0	9.0	28.7	77.8
2	mg/l		20.1	8.9	29.0	77.0
3	mg/l		—	—	25.7	77.3
4	mg/l		—	—	26.4	77.4
Total Organic Halogen - 1	µg/l		220	54	34	189
2	µg/l		190	49	38	188
3	µg/l		180	42	14	211
4	µg/l		140	46	23	195
<u>Groundwater Quality</u>						
Chloride	mg/l		580	490	290	472
Iron	mg/l		0.28	0.18	0.2	0.4
Manganese	mg/l		5.32	5.92	4.10	5.35
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		1792	1550	1250	1600
Sulfate	mg/l		4900	4200	3200	4090
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	0.02	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	0.0002
Selenium	mg/l		<0.01	<0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.70	0.35	0.3	0.47
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		170	1200	666	570
Gross Beta	pCi/l		50	430	422	340
Radium-226	pCi/l		<2	<1	<1	<1

WELL 13-16N, DOWNGRADIENT

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			6.85	6.8	6.8	7.0
2			6.85	6.8	6.8	7.0
3			6.85	6.8	6.8	7.0
4			6.85	6.8	6.8	7.0
Specific Conductance - 1	µmhos/cm		8960	8200	8330	8750
2	µmhos/cm		8960	8200	8330	8750
3	µmhos/cm		8960	8200	8330	8750
4	µmhos/cm		8960	8200	8330	8750
Total Organic Carbon - 1	mg/l		580	137	96.3	45.3
2	mg/l		538	138	95.4	44.5
3	mg/l		--	--	58.1	44.4
4	mg/l		--	--	60.1	44.3
Total Organic Halogen - 1	µg/l		1700	250	94	124
2	µg/l		1200	250	95	202
3	µg/l		1100	270	87	178
4	µg/l		1100	280	117	170
<u>Groundwater Quality</u>						
Chloride	mg/l		640	510	350	348
Iron	mg/l		0.83	3.51	0.9	3.00
Manganese	mg/l		5.50	5.54	6.04	4.33
Phenolics, Total	mg/l		<0.01	0.02	0.01	<0.01
Sodium	mg/l		2610	2320	2020	1850
Sulfate	mg/l		3700	3600	3900	3660
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	0.01	0.02	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		1.13	0.38	0.6	0.58
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	<0.23
Endrin	µg/l		<0.12	--	<0.048	<0.12
Lindane	µg/l		<0.8	--	<0.16	<0.08
Methoxychlor	µg/l		<5	--	<2	<5
Toxaphene	µg/l		<48	--	<1.92	<4.8
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<20	--	<0.4	<0.2
2,4,5-TP (Silvex)	µg/l		<10	--	<0.2	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<10
Gross Alpha	pCi/l		80	540	331	225
Gross Beta	pCi/l		<50	240	225	120
Radium-226	pCi/l		<2	5	4	1.3

## WELL 15-17N, DOWNGRADIENT

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.15	7.2	7.2	7.2
2			7.15	7.2	7.2	7.2
3			7.15	7.2	7.2	7.2
4			7.15	7.2	7.2	7.2
Specific Conductance - 1	µmhos/cm		4514	5300	4914	8370
2	µmhos/cm		4514	5300	4914	8370
3	µmhos/cm		4514	5300	4914	8370
4	µmhos/cm		4514	5300	4914	8370
Total Organic Carbon - 1	mg/l		9.2	18.0	44.6	32.4
2	mg/l		9.0	17.9	42.0	32.4
3	mg/l		—	—	43.3	31.9
4	mg/l		—	—	41.5	32.0
Total Organic Halogen - 1	µg/l		2800	34	15	80
2	µg/l		2300	26	35	76
3	µg/l		2900	39	19	73
4	µg/l		2600	33	39	78
<u>Groundwater Quality</u>						
Chloride	mg/l		190	250	196	226
Iron	mg/l		2.55	3.48	1.8	2.51
Manganese	mg/l		3.60	5.03	3.80	4.08
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		1188	1160	1130	1200
Sulfate	mg/l		2700	3200	2480	2790
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	0.0002
Selenium	mg/l		<0.01	<0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.49	0.32	0.3	0.36
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.4	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.2	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<10
Gross Alpha	pCi/l		310	1600	971	730
Gross Beta	pCi/l		130	430	604	490
Radium-226	pCi/l		<2	<1	<1	<1

WELL 17-13N, DOWNGRADIENT

RCRA Parameter		Units	11/84	2/85	5/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.2	7.2	7.2	7.4
2			7.2	7.2	7.2	7.4
3			7.2	7.2	7.2	7.4
4			7.2	7.2	7.2	7.4
Specific Conductance - 1	µmhos/cm		1512	1200	786	905
2	µmhos/cm		1512	1200	786	905
3	µmhos/cm		1512	1200	786	905
4	µmhos/cm		1512	1200	786	905
Total Organic Carbon - 1	mg/l		5.7	9.0	9.2	11.2
2	mg/l		5.4	8.9	9.1	12.1
3	mg/l		—	—	8.7	11.6
4	mg/l		—	—	9.0	11.7
Total Organic Halogen - 1	µg/l		17000	7	16	317
2	µg/l		12000	<5	<5	301
3	µg/l		15000	6	11	275
4	µg/l		13000	6	12	298
<u>Groundwater Quality</u>						
Chloride	mg/l		38	19	7	7.2
Iron	mg/l		<0.10	0.03	<0.1	<0.03
Manganese	mg/l		2.72	1.95	0.85	0.92
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		166	138	88	107
Sulfate	mg/l		780	530	250	306
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	<0.005	<0.005	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.40	0.33	0.4	0.40
Nitrate-Nitrogen	mg/l		<0.023	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.024	<0.012
Lindane	µg/l		<0.008	<0.008	<0.016	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<1.0	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.96	<0.48
2,4-Dichlorophenoxyacetic Acid (3,4-D)	µg/l		<0.2	<0.2	<0.4	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.2	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		50	80	23	21
Gross Beta	pCi/l		<50	<50	17	15
Radium-226	pCi/l		<2	<1	<1	<1

## Appendix B

### RESULTS OF RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) COMPLIANCE MONITORING AT THE MONTICELLO, UTAH, MILLSITE

This appendix presents tabulated results of the 1985 quarterly groundwater monitoring program conducted at the Monticello, Utah, millsite in response to requirements of the Resource Conservation and Recovery Act. Well numbers and designations as to background or downgradient and alluvial aquifer or Burro Canyon aquifer are noted at the top of each table. Results are presented for November 1984, April 1985, June 1985, and October 1985. The data in each table are organized according to the RCRA parameters specified in 40 CFR Part 265.93. For the Groundwater Contamination parameters, four replicates of each sample must be analyzed according to the requirements of the Act; these are designated as 1, 2, 3, and 4 in the tables. Values for specific conductance are corrected to 25°C.

It should be noted that a dead muskrat was found and removed from Well 76 (page B-10) in mid-September 1985. A significant amount of decay had already occurred, contributing to the high total organic carbon values observed in the June and October samplings of this well.

WELL 20, BACKGROUND, ALLUVIAL AQUIFER

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			6.9	6.5	6.7	6.8
2			6.9	6.5	6.7	6.8
3			6.9	6.5	6.7	6.8
4			6.9	6.5	6.7	6.8
Specific Conductance - 1	µmhos/cm		726	878	1048	945
2	µmhos/cm		726	878	1048	945
3	µmhos/cm		726	878	1048	945
4	µmhos/cm		726	878	1048	945
Total Organic Carbon - 1	mg/l		3.6	2.4	8.1	5.8
2	mg/l		3.6	2.4	8.0	5.8
3	mg/l		3.5	—	7.5	5.4
4	mg/l		3.5	—	7.4	5.5
Total Organic Halogen - 1	µg/l		10000	<5	<5	24
2	µg/l		8520	8.3	9	24
3	µg/l		10000	—	6	19
4	µg/l		7200	—	7	28
<u>Groundwater Quality</u>						
Chloride	mg/l		8	16	18	9
Iron	mg/l		0.25	0.4	0.1	0.06
Manganese	mg/l		1.31	1.02	0.63	0.74
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		28.2	31.1	37.9	35.3
Sulfate	mg/l		200	210	324	230
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	0.002	<0.0002	<0.0002
Selenium	mg/l		<0.01	0.006	<0.01	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.17	0.2	0.2	0.16
Nitrate-Nitrogen	mg/l		<1.1	0.67	1.8	0.90
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2-4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		<15	<13	15	<11
Gross Beta	pCi/l		<50	<5	10	<18
Radium-226	pCi/l		<2	<1	<1	<1

**WELL 1, DOWNGRAIENT, ALLUVIAL AQUIFER**

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.3	6.7	6.8	6.85
2			7.3	6.7	6.8	6.85
3			7.3	6.7	6.8	6.85
4			7.3	6.7	6.8	6.85
Specific Conductance - 1	µmhos/cm		2142	1434	2620	2714
2	µmhos/cm		2142	1434	2620	2714
3	µmhos/cm		2142	1434	2620	2714
4	µmhos/cm		2142	1434	2620	2714
Total Organic Carbon - 1	mg/l		4.3	4.7	12.3	10.0
2	mg/l		4.2	4.7	13.4	10.5
3	mg/l		4.3	--	11.2	10.4
4	mg/l		4.2	--	11.1	10.0
Total Organic Halogen - 1	µg/l		5700	36	2076	84
2	µg/l		5600	39	2056	88
3	µg/l		4200	--	2114	82
4	µg/l		5400	--	2126	84
<u>Groundwater Quality</u>						
Chloride	mg/l		120	110	115	117
Iron	mg/l		<0.1	<0.1	<0.1	<0.03
Manganese	mg/l		3.71	3.24	3.62	4.04
Phenolics, Total	mg/l		<0.01	0.01	0.06	<0.01
Sodium	mg/l		499	459	481	414
Sulfate	mg/l		920	820	941	931
<u>Groundwater Characterization</u>						
Arsenic	mg/l		0.052	0.04	0.03	0.054
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	0.0004	<0.0002	<0.0002
Selenium	mg/l		<0.01	0.01	<0.01	0.016
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.77	0.7	0.7	0.75
Nitrate-Nitrogen	mg/l		<1.1	1.1	0.9	0.9
Endrin	µg/l		<0.012	<0.012	<0.012	<0.024
Lindane	µg/l		<0.008	<0.008	<0.008	<0.016
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<1.0
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.96
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.4
2,4,5-TP (Silverx)	µg/l		<0.1	<0.1	<0.1	<0.2
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		340	680	1410	1270
Gross Beta	pCi/l		150	560	708	722
Radium-226	pCi/l		<2	<1	<1	<1

**WELL 36A, DOWNGRADIENT, ALLUVIAL AQUIFER**

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.5	6.9	6.95	6.8
2			7.5	6.9	6.95	6.8
3			7.5	6.9	6.95	6.8
4			7.5	6.9	6.95	6.8
Specific Conductance - 1	µmhos/cm		3564	5214	5655	7155
2	µmhos/cm		3564	5214	5655	7155
3	µmhos/cm		3564	5214	5655	7155
4	µmhos/cm		3564	5214	5655	7155
Total Organic Carbon - 1	mg/l		5.5	9.8	13.5	17.8
2	mg/l		5.6	9.6	13.6	17.5
3	mg/l		5.6	—	13.7	16.7
4	mg/l		5.7	—	13.6	16.4
Total Organic Halogen - 1	µg/l		670	56	49	57
2	µg/l		900	58	31	46
3	µg/l		730	—	17	56
4	µg/l		730	—	19	63
<u>Groundwater Quality</u>						
Chloride	mg/l		150	620	109	92
Iron	mg/l		2.08	0.5	<0.1	<0.03
Manganese	mg/l		9.69	15.3	15.0	15.6
Phenolics, Total	mg/l		<0.01	<0.01	0.02	<0.01
Sodium	mg/l		831	1260	1120	1270
Sulfate	mg/l		2600	4400	3450	3570
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	0.02	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	0.002	0.003	0.005
Chromium	mg/l		0.02	0.02	0.017	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	0.0008	<0.0002	<0.0002
Selenium	mg/l		<0.01	<0.005	<0.01	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		1.01	1.0	0.9	0.89
Nitrate-Nitrogen	mg/l		3.2	36	19	16
Endrin	µg/l		<0.012	<0.012	<0.012	<0.024
Lindane	µg/l		<0.008	<0.008	<0.008	<0.016
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<1.0
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.96
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.4
2,4,5-TP (Silver)	µg/l		<0.1	<0.1	<0.1	<0.2
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		1100	5530	7280	3510
Gross Beta	pCi/l		390	4230	3780	1900
Radium-226	pCi/l		17	20	44	20

WELL 40A, DOWNGRAIENT, ALLUVIAL AQUIFER

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			6.9	6.9	7.0	7.1
2			6.9	6.9	7.0	7.1
3			6.9	6.9	7.0	7.1
4			6.9	6.9	7.0	7.1
Specific Conductance - 1	µmhos/cm		1920	1755	1885	2210
2	µmhos/cm		1920	1755	1885	2210
3	µmhos/cm		1920	1755	1885	2210
4	µmhos/cm		1920	1755	1885	2210
Total Organic Carbon - 1	mg/l		6.1	6.0	20.1	33.1
2	mg/l		6.0	5.6	19.4	33.7
3	mg/l		6.1	—	19.9	32.8
4	mg/l		6.2	—	19.7	33.0
Total Organic Halogen - 1	µg/l		1500	34	9904	46
2	µg/l		2200	32	9458	47
3	µg/l		1900	—	10578	48
4	µg/l		1900	—	9166	49
<u>Groundwater Quality</u>						
Chloride	mg/l		130	89	98	116
Iron	mg/l		0.8	0.3	0.1	0.46
Manganese	mg/l		4.20	2.44	2.80	3.79
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		420	328	326	364
Sulfate	mg/l		790	510	553	714
<u>Groundwater Characterization</u>						
Arsenic	mg/l		0.086	0.08	0.05	0.072
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	<0.005	<0.01	<0.05
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		1.07	1.1	1.1	1.05
Nitrate-Nitrogen	mg/l		<1.1	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silverx)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		340	440	840	950
Gross Beta	pCi/l		140	400	469	574
Radium-226	pCi/l		10	5	4.1	6.9

**WELL 77, BACKGROUND, BURRO CANYON AQUIFER**

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.4	6.9	7.4	8.0
2			7.4	6.9	7.4	8.0
3			7.4	6.9	7.4	8.0
4			7.4	6.9	7.4	8.0
Specific Conductance - 1	µmhos/cm		455	521	524	539
2	µmhos/cm		455	521	524	539
3	µmhos/cm		455	521	524	539
4	µmhos/cm		455	521	524	539
Total Organic Carbon - 1	mg/l		1.0	3.3	17.6	3.0
2	mg/l		0.9	3.4	16.6	2.7
3	mg/l		1.0	—	16.9	3.4
4	mg/l		1.0	—	16.3	2.7
Total Organic Halogen - 1	µg/l		76	5.0	32.4	—
2	µg/l		110	<5	<5	—
3	µg/l		104	—	<5	—
4	µg/l		99	—	<5	—
<u>Groundwater Quality</u>						
Chloride	mg/l		3	7	3	3
Iron	mg/l		<0.1	0.1	<0.1	<0.03
Manganese	mg/l		0.36	0.33	0.31	0.31
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		61.4	41.6	40.4	42.1
Sulfate	mg/l		98	96	93	91
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	<0.005	<0.01	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.17	0.1	0.2	0.14
Nitrate-Nitrogen	mg/l		<1.1	<0.23	<0.23	0.45
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		<15	<8	<6	5.7
Gross Beta	pCi/l		<50	5	4	<9
Radium-226	pCi/l		<2	<1	<1	<1

**WELL 74, DOWNGRADIANT, BURRO CANYON AQUIFER**

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.8	7.0	7.2	7.5
2			7.8	7.0	7.2	7.5
3			7.8	7.0	7.2	7.5
4			7.8	7.0	7.2	7.5
Specific Conductance - 1	µmhos/cm		503	496	590	567
2	µmhos/cm		503	496	590	567
3	µmhos/cm		503	496	590	567
4	µmhos/cm		503	496	590	567
Total Organic Carbon - 1	mg/l		1.2	0.9	1.9	2.1
2	mg/l		1.2	1.0	2.0	1.6
3	mg/l		1.2	—	1.7	2.0
4	mg/l		1.2	—	1.4	1.4
Total Organic Halogen - 1	µg/l		30	<5	139	24
2	µg/l		31	6.7	167	18
3	µg/l		24	—	144	14
4	µg/l		36	—	155	18
<u>Groundwater Quality</u>						
Chloride	mg/l		4	4	5	4
Iron	mg/l		0.12	0.2	0.1	0.12
Manganese	mg/l		0.18	0.16	0.17	0.17
Phenolics, Total	mg/l		<0.01	<0.01	0.03	<0.01
Sodium	mg/l		77.3	71.0	68.0	75.0
Sulfate	mg/l		110	110	97	98
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	0.006	<0.01	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.22	0.2	0.2	0.15
Nitrate-Nitrogen	mg/l		<1.1	<0.23	<0.23	0.45
Endrin	µg/l		—	<0.012	<0.012	<0.012
Lindane	µg/l		—	<0.008	<0.008	<0.008
Methoxychlor	µg/l		—	<0.50	<0.50	<0.50
Toxaphene	µg/l		—	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		—	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		—	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		<15	<8	7	<6
Gross Beta	pCi/l		<50	5	6	<9
Radium-226	pCi/l		<2	<1	<1	<1

**WELL 75, DOWNGRADIENT, BURRO CANYON AQUIFER**

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.8	7.2	7.3	7.7
2			7.8	7.2	7.3	7.7
3			7.8	7.2	7.3	7.7
4			7.8	7.2	7.3	7.7
Specific Conductance - 1	µmhos/cm		340	545	585	574
2	µmhos/cm		340	545	585	574
3	µmhos/cm		340	545	585	574
4	µmhos/cm		340	545	585	574
Total Organic Carbon - 1	mg/l		6.2	11.5	3.0	1.0
2	mg/l		6.0	10.8	3.2	0.8
3	mg/l		6.0	—	3.2	0.8
4	mg/l		6.1	—	2.9	1.1
Total Organic Halogen - 1	µg/l		150	<5	<5	17
2	µg/l		200	6.1	<5	12
3	µg/l		150	—	<5	18
4	µg/l		160	—	<5	17
<u>Groundwater Quality</u>						
Chloride	mg/l		5	5	5	5
Iron	mg/l		<0.1	<0.1	<0.1	<0.03
Manganese	mg/l		<0.05	<0.05	<0.05	0.04
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	<0.01
Sodium	mg/l		109	100	93.2	101
Sulfate	mg/l		96	93	90	88
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		<0.1	<0.1	<0.1	<0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	<0.005	<0.01	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.30	0.2	0.2	0.17
Nitrate-Nitrogen	mg/l		<1.1	<0.23	<0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		—	<1	<1	<1
Gross Alpha	pCi/l		<15	<7	6	<6
Gross Beta	pCi/l		<50	5	5	<9
Radium-226	pCi/l		<2	<1	<1	<1

**WELL 76, DOWNGRAIENT, BURRO CANYON AQUIFER**

RCRA Parameter		Units	11/84	4/85	6/85	10/85
<u>Groundwater Contamination</u>						
pH - 1			7.8	6.8	7.7	7.3
2			7.8	6.8	7.7	7.3
3			7.8	6.8	7.7	7.3
4			7.8	6.8	7.7	7.3
Specific Conductance - 1	µmhos/cm		403	435	426	574
2	µmhos/cm		403	435	426	574
3	µmhos/cm		403	435	426	574
4	µmhos/cm		403	435	426	574
Total Organic Carbon - 1	mg/l		4.4	3.0	58	131
2	mg/l		4.5	3.0	58	133
3	mg/l		4.5	—	61.0	129
4	mg/l		4.6	—	60.3	127
Total Organic Halogen - 1	µg/l		37	<5	<5	—
2	µg/l		34	<5	<5	—
3	µg/l		27	—	<5	—
4	µg/l		38	—	<5	—
<u>Groundwater Quality</u>						
Chloride	mg/l		4	3	4	4
Iron	mg/l		<0.1	<0.1	<0.1	0.03
Manganese	mg/l		<0.05	<0.05	<0.05	0.02
Phenolics, Total	mg/l		<0.01	<0.01	<0.01	0.32
Sodium	mg/l		96.8	90.2	85.3	95.3
Sulfate	mg/l		58	55	53	19
<u>Groundwater Characterization</u>						
Arsenic	mg/l		<0.01	<0.01	<0.01	<0.01
Barium	mg/l		0.1	<0.1	0.1	0.1
Cadmium	mg/l		<0.002	<0.001	<0.001	<0.001
Chromium	mg/l		<0.01	<0.01	<0.01	<0.01
Lead	mg/l		<0.01	<0.01	<0.01	<0.01
Mercury	mg/l		<0.001	<0.0002	<0.0002	<0.0002
Selenium	mg/l		<0.01	<0.005	<0.01	<0.005
Silver	mg/l		<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l		0.46	0.3	0.3	0.26
Nitrate-Nitrogen	mg/l		<1.1	<0.23	0.23	<0.23
Endrin	µg/l		<0.012	<0.012	<0.012	<0.012
Lindane	µg/l		<0.008	<0.008	<0.008	<0.008
Methoxychlor	µg/l		<0.50	<0.50	<0.50	<0.50
Toxaphene	µg/l		<0.48	<0.48	<0.48	<0.48
2,4-Dichlorophenoxyacetic Acid (2,4-D)	µg/l		<0.2	<0.2	<0.2	<0.2
2,4,5-TP (Silvex)	µg/l		<0.1	<0.1	<0.1	<0.1
Coliform, Total	colonies/100 ml		<1	<1	<1	<1
Gross Alpha	pCi/l		<15	<6	<4	<7
Gross Beta	pCi/l		<50	<5	3	<18
Radium-226	pCi/l		<2	<1	<1	<1